



King's Research Portal

Document Version
Peer reviewed version

[Link to publication record in King's Research Portal](#)

Citation for published version (APA):

Araújo dos Santos, M., A de Souza, B., Guimarães, N., Escobal, F. C., Lazzarotto, P. B., Souvestre, P. A., & Russomano, T. (2018). The Effects of Hypergravity and Radiation Exposure on Plants and their Terrestrial and Space Applications. In *Aerospace Medicine and Human Performance Journal* (3 ed., Vol. 89, pp. 179-180)

Citing this paper

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

General rights

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

Take down policy

If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

Abstract Type:

Topic Area: 4: Space Medicine 4.2: Space Operations

Title: The Effects of Hypergravity and Radiation Exposure on Plants and their Terrestrial and Space Applications

Authors: Marlise A dos Santos, Ph.D.¹, Beatriz A de Souza¹, Natalia Guimarães¹, Felipe C Escobal¹, Patrícia B. Lazzarotto¹, Philippe A Souvestre², Thais Russomano³.

¹Microgravity Centre- PUCRS, Av Ipiranga, 6681, Partenon - Porto Alegre, 90619-900 / RS/ Brazil, marlise.santos@pucrs.br

² NeuroKinetics Health Services, Inc., Hycroft Medical Centre, 60-3195 Granville St., Vancouver, BC, V6H 3K2, Canada, pas@neurokinetics.com

³ Centre of Human and Aerospace Physiological Sciences, School of Basic and Medical Biosciences, Faculty of Life Sciences and Medicine, King's College London, Shepherd's House, Guy's Campus, London SE1 1UL, thais.russomano@kcl.ac.uk

Introduction: The Bellagio II Summit discussed several aspects related to space nutrition, space pharmacy and the influence of the space environment on plants and their compounds. Plant germination and growth are influenced by innumerable environmental factors, such as the level of gravity and type of radiation. Since several plants have nutritive and medicinal value, the importance of their cultivation and consumption during space missions are unquestionable. Studies have demonstrated that simulated hypergravity through centrifuge exposure increases the number of seed germination, accelerates plant growth and the modifies metabolites produced by some plants. The radiation of space, either in Low Earth Orbit or in deep space, can also positively impact on plant growth and metabolite production.

Methods: The effects of different levels of gravitational fields and types of radiation on plant germination and development were reviewed for application in space missions and food and pharmaceutical industries on Earth.

Results: Faster germination and increased growth of Rocket plant seeds, as well as higher rates of germination of carrot seeds were observed when subjected to intermittent exposure at +7Gz. The scientific literature shows that using UV-C radiation (non-ionizing radiation) on arugula increased its production of antioxidant and polyphenols compounds, and shortened strawberry maturation by 4 to 8 days, without affecting the average weight of the fruit. Gamma (ionizing) radiation, however, reduced the average height of fava beans, but did not affect germination. It can also be used to disinfect vegetables.

Discussion: This paper reviewed the literature related to the effects of hypergravity conditions, as well as different types of radiation exposure on the plant life cycle and production of their compounds. The findings reviewed suggest that several plants present faster rates of germination and growth under hypergravity conditions. This may motivate the cultivation of such plants and vegetables using this method, not only on Earth, but also in more extreme environments, such as those found on space stations and extra-terrestrial bases. Studies conducted worldwide have demonstrated the potential advantages of applying radiation on plants. Hypergravity and radiation exposure, therefore, might be useful for terrestrial applications, especially in food production and medication development.